

ACCESSION #: 9601260138

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Sequoyah Nuclear Plant (SQN), Unit 2 PAGE: 1 OF 5

DOCKET NUMBER: 05000328

TITLE: Reactor Trip With Auxiliary Feedwater Start and Feedwater

Isolation as a Result of a Switchyard Power Circuit

Breaker Failure

EVENT DATE: 12/21/95 LER #: 95-007-00 REPORT DATE: 01/19/96

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: J. Bajraszewski, Compliance TELEPHONE: (423) 843-7749

Licensing Engineer

COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: EL COMPONENT: 52 MANUFACTURER: D095

REPORTABLE NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On December 21, 1995, at approximately 0629 Eastern standard time (EST), with Unit 2 in power operation at approximately 100 percent, a manual reactor trip was initiated because of a loss of condenser vacuum. At approximately 0626 EST, protection relays operated, opening breakers in the 161-kilovolt switchyard, clearing a ground fault on the Chickamauga 2 line in Power Circuit Breaker (PCB) 974. The ground fault duration was

approximately five cycles. The electrical perturbation was sensed by protection circuitry on the synchronous motors of the condenser circulating water (CCW) pumps, resulting in the three Unit 2 pumps tripping and initiating the loss of condenser vacuum. When condenser pressure reached established limits, operators took manual control and tripped the unit. Main control room operators entered the appropriate procedures and stabilized the unit in hot standby (Mode 3). The reactor protection systems responded to the trip as expected; no anomalies occurred. Main feedwater isolated, and auxiliary feedwater pumps started as designed. The root cause of the ground fault was the failure of the C phase of PCB 974. A preliminary evaluation indicates that a potential latent defect was present in the ceramic insulator on the load side of the center head assembly. The failed PCB has been spared out and does not affect unit operation. A review of industry experience indicated that the failure was unique. Additionally, a study is in progress to develop economical solutions to alleviate the sensitivity of the CCW pump motor protection scheme without jeopardizing equipment or personnel safety.

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## I. PLANT CONDITIONS

Unit 2 was in power operation at approximately 100 percent.

## II. DESCRIPTION OF EVENT

### A. Event

On December 21, 1995, at approximately 0629 Eastern standard time (EST), a manual reactor trip was initiated because of a loss of condenser vacuum [EIIS CODE SG]. At approximately 0626 EST, protection relays operated, opening breakers in the 161 - kilovolt (kV) switchyard, clearing a ground fault on the Chickamauga 2 line in Power Circuit Breaker (PCB) 974 [EIIS CODE FK] and deenergizing Bus 1 of the 161-kV switchyard. The ground fault duration was approximately five cycles. The electrical perturbation was sensed by protection circuitry on the synchronous motors of the condenser circulating water (CCW)

pumps [EHS CODE KE], resulting in the three Unit 2 pumps tripping and initiating the loss of condenser vacuum. When condenser pressure reached established limits, operators took manual control and tripped the unit. Main control room (MCR) operators entered the appropriate procedures and stabilized the unit in hot standby (Mode 3). The reactor protection systems responded to the trip as expected; no anomalies occurred. Main feedwater isolated and auxiliary feedwater (AFW) pumps started as designed.

B. Inoperable Structures, Components, or Systems that Contributed to the Event None.

C. Dates and Approximate Times of Major Occurrences

December 21, 1995 at Protection relays operated, opening 0626 EST breakers in the 161-kV switchyard,

clearing a ground fault on the

Chickamauga 2 line in PCB 974 and

deenergizing Bus 1 of the 161-kV

switchyard.

0626 EST Two of three Unit 1 CCW pumps and

three of three Unit 2 CCW pumps

tripped.

0627 EST A Unit 2 operator recognized that Unit

2 condenser pressure was quickly

increasing and notified the crew.

0629 EST Condenser pressure continued to

increase, and operators took manual

control, tripping the Unit 2

reactor/turbine. MCR operators

entered the appropriate procedures to

stabilize the unit. AFW pumps (motor-

and turbine-driven) started because of

LoLo level in Steam Generators 1 and

4. Main feedwater isolation occurred

because of low average temperature (T

sub avg) in coincidence with the

reactor trip.

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0634 EST The 2A CCW pump was placed in service

for the reestablishment of condenser

vacuum.

0644 EST Unit 2 was stabilized in Mode 3.

#### D. Other Systems or Secondary Functions Affected

The switchyard condition initiated a loss of power to the plant

security system. The electrical perturbation was sensed by

security system electrical supply circuitry. The system

transferred to an uninterruptible power source; however, the

transfer failed because of a faulty battery. This resulted in the loss of power to computers that control entry and exit turnstiles at the personnel access portal, some cameras, and glare lighting. Upon the failure of the security equipment, Nuclear Security immediately implemented the compensatory action required by the plant security plan to address the condition.

#### E. Method of Discovery

The switchyard fault, loss of the CCW pumps, and increase of condenser vacuum was annunciated or indicated on the MCR panels. Oscillograph charts identified a ground fault of approximately five cycles in duration on the C-phase of PCB 974.

#### F. Operator Actions

Operators promptly diagnosed the plant condition and took the appropriate action, tripping the reactor/turbine and stabilizing the unit in the hot standby condition (Mode 3).

#### G. Safety System Responses

Safety systems performed and plant parameters responded as expected for the reactor and turbine trips.

An evaluation of the 161-kV switchyard differential relay operation determined that the protection circuitry operated as designed. A heavy C phase ground fault occurred for

approximately five cycles. Protection relays actuated the appropriate breakers, isolating the bus and clearing the fault.

### III. CAUSE OF EVENT

#### A. Immediate Cause

The immediate cause of the manual reactor trip was a loss of condenser vacuum. The loss of condenser vacuum was a result of the three Unit 2 CCW pumps tripping on a voltage swing in the exciter field of the synchronous motors.

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#### B. Root Cause

The root cause of the event was failure of the C phase of PCB 974 in the 161-kV switchyard. Examination of the breaker identified a potential latent defect in the ceramic insulator on the load side of the center head assembly. Based on the observed potential defect, it is theorized that the failure of this subassembly applied an opposing reactive force on the main assembly and caused the main chamber porcelain to fail. This resulted in the breaker assembly falling and a ground fault (the plant side connector came into contact with the operating rod of the switch). The ground fault generated an electrical perturbation of other 161-kV lines.

#### C. Contributing Factors

Contributing to the event was the loss of the CCW pumps. Loss of the CCW pumps was a result of the protection circuitry on the synchronous motors not being able to handle short duration (five cycle) electrical perturbations,

#### IV. ANALYSIS OF EVENT

The C phase to ground fault resulted in the CCW pumps tripping. The CCW pumps provide cooling water to the plant condenser to remove heat from the condensate system. The loss of heat removal capability resulted in a loss of condenser vacuum. The loss of condenser vacuum required the unit to be manually tripped. The fault caused the C-phase voltage in the 161-kV switchyard to drop to zero. Protection relays actuated the appropriate breakers, isolating the 161-kV Bus 1 and clearing the Chickamauga 2 line that contained the fault. These protection relays and breakers operated as designed within the expected duration. Operators promptly diagnosed the plant conditions and took effective action to shut down and stabilize the unit. Safety systems responded as described by the Final Safety Analysis Report. Safety parameters remained within the design basis of the plant. Therefore, this event did not result in adverse consequences to plant personnel or to the general public.

#### V. CORRECTIVE ACTIONS

##### A. Immediate Corrective Action

The control room staff promptly diagnosed the plant conditions and took action to shutdown and stabilize the unit.

#### B. Corrective Action to Prevent Recurrence

The failed PCB has been spared out and does not affect unit operation. A review of industry experience indicated that the failure was unique.

A study is in progress to develop solutions to alleviate the sensitivity of the CCW pump motor protection scheme without jeopardizing equipment or personnel safety.

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### VI. ADDITIONAL INFORMATION

#### A. Failed Components

The failed component of this event was an air-blast PCB. The PCB was a Delle-Alsthom type PK-2-SB, Serial No. 12169, manufactured in 1972.

#### B. Previous Similar Events

A review of previous reportable events identified LER 50-327/92027 associated with the failure of a PCB in the 500-kV switchyard as a result of an internal fault. The cause of the PCB failure in that event was breaker-testing methodology and bypassing primary breaker protection. Actions taken for that event would not have prevented the condition described in this LER.

## VII. COMMITMENTS

None.

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Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy,  
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R. J. Adney

Site Vice President

Sequoyah Nuclear Plant

January 19, 1996

U. S. Nuclear Regulatory Commission

ATTN: Document Control Desk

Washington, D.C. 20555

Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT (SQN)  
UNIT 2 - DOCKET NO. 50-328 - FACILITY OPERATING LICENSE DPR-79-  
LICENSEE EVENT REPORT (LER) 50-328/95007

The enclosed report provides details concerning a manual reactor trip with feedwater isolation and auxiliary feedwater start as a result of a switchyard power circuit breaker failure. This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv) as a condition that resulted in the actuation of engineered safety features including the reactor protection system.

Sincerely,

R. J. Adney

Enclosure

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U. S. Nuclear Regulatory Commission

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January 19, 1996

Enclosure

cc (Enclosure):

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